

Science questions for implementing climate refugia for cold-water fish as an adaptation strategy

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Managing climate refugia has been proposed as a potential adaptation strategy that may be useful for protecting the biotic integrity of watersheds under a changing climate. Paleo-ecological evidence suggests that refugia allowed species to persist through prior periods of climate change, even as surrounding regions became unsuitable. Now managers are asking how refugia might help species persist under future climates. The potential effectiveness of climate refugia as a climate adaptation strategy has several critical uncertainties, including: What physical processes create and maintain refugia? How will these change given climate projections? At what spatial scales must these drivers be considered to maintain species within refugia? Given that paleo-refugia functioned in the absence of a significant human footprint, how will climate change and other anthropogenic stressors interact to constrain refugia effectiveness in the future? Are current data sufficient to help inform the identification of potential refugia? Are current best-condition 'reference sites' at risk from climate change, limiting their potential utility as refugia sentinels and endangering future detection of status and trends? What are implications for developing water quality criteria and standards? We will present these questions and explore options for effective research on the potential management of climate refugia as an adaptation strategy.

Keywords: climate change, adaptation, watershed condition, salmon recovery